REMARKS

INTRODUCTION

The drawing is objected to because "alkali" should be ---alkaline earth---.

The abstract is objected to because "alkali earth" should be ---alkaline earth---.

The disclosure is objected to because all occurrences of "alkali earth" should be ---alkaline earth--- and because $Na_2S_2O_3 \cdot 5H20$ is not sodium sulfate.

Claims 1, 2, 11, 13, 17 and 21 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite.

Claims 3-10, 12, 14-16 and 18-20 are objected to as being dependent upon a rejected base claims, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 22 and 23 are objected to as referring to a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

OBJECTION TO THE DRAWING

On page 2 of the Office Action, the drawing is objected to because "alkali" should be ---alkaline earth---.

The drawing has been corrected by changing "alkali" to ---alkaline earth--- in FIG. 1. Thus, the objection to FIG. 1 is now submitted to be moot.

OBJECTION TO THE ABSTRACT

At page 2 of the Office Action, the abstract is objected to because "alkali earth" should be ---alkaline earth---.

The abstract has been amended by changing "alkali earth" to ---alkaline earth---. Thus, the objection to the abstract is now submitted to be moot.

OBJECTION TO THE DISCLOSURE

At page 2 of the Office Action, the disclosure is objected to because all occurrences of "alkali earth" should be ---alkaline earth--- and because $Na_2S_2O_3 \cdot 5H20$ is not sodium sulfate.

All occurrences of "alkali earth" have been changed to ---alkaline earth---, and the alkaline metal sulfate has been amended to recite ---alkaline metal sulfur-containing compound-- for clarity. In addition, in paragraph 28, $Na_2S_2O_3 \cdot 5H20$ has been identified as sodium thiosulfate pentahydrate. Thus, this objection is now submitted to be moot.

REJECTION UNDER 35 U.S.C. §112

At pages 2-3 of the Office Action, claims 1, 2, 11, 13, 17 and 21 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite.

Claims 1, 2, 13 and 21 have been amended to replace "alkali earth" with ---alkaline earth--, and are now believed to be definite.

Claims 10 and 14 have been amended to change "alkali metal sulfate" to recite --- alkaline metal sulfur-containing compound--- for clarity. Claims 11 and 17 have been amended correspondingly, and are now submitted to be definite.

Claim 21 has been amended to change "alkali" to ---alkaline-- and is now believed to be definite.

With respect to the Examiner's rejection of claim 21 under 35 U.S.C. §112, first paragraph, in which the Examiner submitted that the specification was not enabling for a phosphor with a host matrix having a perovskite structure which includes sulfur, an alkaline earth metal and a rare earth metal where the sulfur atoms partially substitute for oxygen, it is respectfully submitted that the specification is enabling in this regard. First, a perovskite is generally defined as an oxide having the same crystalline structure as the mineral, $CaTiO_3$, which is usually expressed as ABO_3. An ideal perovskite has a structure in which A (cation) is located at the center of the cubic unit cell, B (cation) is located at each corner and O (anion) is located at the center of each side.

As is well known to those skilled in the art, oxygen and sulfur atoms are both members of Group VIA of the periodic table, each having six electrons in their outer shells. Since oxygen and sulfur have outer electron shells having the same number of electrons, oxygen and sulfur tend to form bonds with other atoms in a similar fashion. In example 1 (see page 5 of the specification of the present application), 1 mol of $SrCO_3$, 1 mol of TiO_2, 23 mol% $Al(OH)_3$, 0.5 mol% $PrCl_3$, and 6.2 mol% S were mixed and ground in an alumina mortar and sintered at a temperature of 1,200°C for 3 hours to obtain a phosphor. Examples 2-8 proceed in similar fashion (see Table 1 on page 6 of the specification). Note that S is present in the reaction, leading to presence of S in the phosphor. The amount of S in the host matrix is measured by Inductively Coupled Plasma (ICP) (See Column 2 of Table 1 on page 7 of the specification).

As stated in paragraph 36 of page 7 of the specification: "As described above, the present invention provides a phosphor containing S, which has good luminance and lifespan characteristics compared to conventional $SrTiO_3$ based phosphors, without using cadmium that is harmful to the environment." Thus, it is respectfully submitted that it is clear to one skilled in the art that the specification is enabling for a phosphor with a host matrix having a perovskite structure which includes sulfur, an alkaline earth metal and a rare earth metal where the sulfur atoms partially substitute for oxygen. Hence, it is respectfully submitted that the specification is enabling for one skilled in the art to make the invention commensurate in scope with the claims.

Thus, it is respectfully submitted that claim 21 is allowable under 35 U.S.C. §112, first paragraph.

OBJECTIONS TO CLAIMS

At page 3, claims 3-10, 12, 14-16 and 18-20 are objected to as being dependent upon a rejected base claims, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 1 has been amended to overcome 35 U.S.C. §112, second paragraph, objections and is now submitted to be allowable. Since claims 2-20 depend therefrom, claims 2-20 are submitted to be allowable.

Claims 22 and 23 are objected to as referring to a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 22 has been amended to include the features of claim 1, and amended claim 22 is submitted to be allowable. Since claim 23 depends from amended claim 22, claim 23 is also submitted to be allowable.

In accordance with the foregoing, claims 1, 2, 10, 11, 13, 14, 17, 21, and 22 have been amended. Claims 1-23 are pending and under consideration.

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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ABSTRACT OF DISCLOSURE

A phosphor having longer lifespan which includes sulfur and has a perovskite structure. The phosphor further satisfies the following formula:

$$MTiO_3:A$$

where M is an alkaline earth metal and A is a rare earth element. The sulfur-containing phosphor shows good luminance and lifespan characteristics compared to existing $SrTiO_3$ based phosphors, without containing cadmium that is harmful to the environment. Therefore, the phosphor is advantageously utilized for various display applications including vacuum fluorescent displays (VFDs) and field emission displays (FEDs).